# Chapter 1: Logic and Sets

### Exercises 1.3

1. Decide if the argument described is inductive or deductive:
   1. The first five terms of the sequence were all odd, therefore the sixth term will also be odd.
   2. My dog is afraid of loud noises. Today is the fourth of July so there will be fireworks. My dog will be afraid today. ADD
2. Find the next term of the sequences below
   1. 3, 6, 9, 12, 15, \_\_\_\_
   2. 3, 6, 9, 15, 24, \_\_\_\_ ADD

For questions 3-12: Rewrite each of the following arguments in their “premise, premise, conclusion” form, and determine whether the argument is inductive or deductive. If the argument is inductive, determine its strength. If the argument is deductive, use sets to illustrate and determine the validity of the argument, and state whether the argument is sound.

1. Since all cats are scared of vacuum cleaners and Max is a cat, Max must be scared of vacuum cleaners.
2. Every day for the last year, a plane flew over my house at 2 pm. Therefore, a plane will always fly over my house at 2pm.
3. Kiran collected data on the salaries of their friends. They found that female and nonbinary friends made less than male friends, so they concluded that women and nonbinary people make less than men.
4. Some of these kids are rude. Jimmy is one of these kids. Therefore, Jimmy is rude!
5. All bicycles have two wheels. My friend’s Harley-Davidson has two wheels, so it must be a bicycle.
6. Since all chocolate contains milk and this bar is made of chocolate, it must contain milk.
7. All students drink a lot of caffeine. Brayer drinks a lot of caffeine, so he must be a student.
8. Over the course of a year, data was collected on the number of students visiting the Cafeteria during the week. On average, there were 15-35 students present in the cafeteria during peak hours. Tomorrow is Monday. We can expect there to be between 15 and 35 students in the cafeteria if we go during the peak hours of the day.
9. If a person is on this reality show, they must be self-absorbed. Laura is not self-absorbed. Therefore, Laura cannot be on this reality show.
10. The first few terms of the sequence are 1, 3, 5, 7, 9 therefore the next term will be 11. ADD

For 13-20, draw the appropriate illustration of sets (Subset, Disjoint or Overlapping). Then put an X to represent the subject of the conclusion. Or two question marks to illustrate the subject could into two locations. Finally, state if the conclusion is valid and sound.

1. Premise: No apples are pears.  
   Premise:  A Pink Lady is an apple.  
   Conclusion: Therefore, a Pink Lady is not a pear.
2. Premise: All children are young.   
   Premise: Tamika is young.   
   Conclusion: Therefore, Tamika is a child.
3. Premise: Some goats faint.  
   Premise: Fizzy faints.  
   Conclusion: Therefore, Fizzy is a goat.
4. Premise: All students who miss more than 25% of class time fail.   
   Premise: Claudia failed my class.  
   Conclusion: Claudia missed more than 25% of class time.
5. Premise: All students who miss more than 25% of class time fail.   
   Premise: Ethan missed more than 25% of class time.   
   Conclusion: Ethan failed.
6. Premise: All dogs eat apples.   
   Premise: Mary ate an apple.   
   Conclusion: Mary is a dog. ADD
7. Premise: Some entering freshmen have to take a placement test.   
   Premise: Juan is an entering freshman.   
   Conclusion: Juan has to take a placement test. ADD
8. Premise: No cats like peanut butter.   
   Premise: Bob does not like peanut butter.   
   Conclusion: Bob is a cat. ADD

### Answers

* 1. The argument is inductive
  2. The argument is deductive

1. 1. The next term is 18
   2. The next term is 39
2. Premise: All cats are scared of vacuum cleaners

Premise: Max is a cat

Conclusion: Max must be scared of vacuum cleaners  
  
This is a deductive argument. It is valid. However, it is not sound because the premise all cats are afraid of vacuum cleaners is false. While many cats are afraid of vacuum cleaners not ALL cats are afraid. There are many videos of cats riding electronic vacuum cleaners.

Max

*U*

Afraid of Vacuums

Cats

1. Premise: Every day for the last year, a plane flew over my house at 2 pm  
   Conclusion: A plane will always fly over my house at 2pm

This is an inductive argument. It is a strong argument because a large quantity of data has been collected.

1. Premise: Kiran’s female and nonbinary friends made less than Kiran’s male friends  
   Conclusion: Women and nonbinary people make less than men  
     
   This is an inductive argument. Kiran did not gather a large diverse sample because they only asked their friends. Therefore, their data has sampling bias. This makes their argument weak.
2. Premise: Some of these kids are rude.  
   Premise: Jimmy is one of these kids  
   Conclusion: Jimmy is rude!  
     
   This is a deductive argument. This conclusion is not valid. Jimmy could be one of these rude kids, he could also be a kid who is not rude. Because the conclusion is not valid it is also not sound.

*U*

Kids ?  
  
?

Rude People

1. Premise: All bicycles have two wheels  
   Premise: My friend’s Harley-Davidson has two wheels  
   Conclusion: It must be a bicycle  
     
   This is a deductive argument. The conclusion is not valid. Based on the premises we can know the Harley-Davidson has two wheels but we cannot put it in the subset that is Bicycles. Because it is not valid it is also not sound.

*U*

Two wheeled things   
?

?

Bicycles

1. Premise: All chocolate contains milk  
   Premise: This bar is made of chocolate  
   Conclusion: It must contain milk.

*U*

Things that contain milk

Chocolate  
  
This Bar

This is a deductive argument. The conclusion is valid. This bar is in the set of chocolate and chocolate is in the set of things that contain milk. However, this conclusion is not sound because not all chocolate contains milk.

1. Premise: All students drink a lot of caffeine  
   Premise: Brayer drinks a lot of caffeine  
   Conclusion: He must be a student

*U*

Coffee Drinkers  
?

?

Students

This is a deductive argument. The conclusion is not valid. We can not determine if Brayer is a student or not. Because it is not valid it is also not sound.

1. Premise: Over one year on average, there were 15-35 students present in the cafeteria during the peak hours   
   Premise: Tomorrow is Monday  
   Conclusion: There is going to be between 15 and 35 students in the cafeteria if we go during the peak hours of the day  
     
   This is an inductive argument. This argument is strong because the conclusion is supported by the premises, they gathered a large amount of data over a long period of time on week days and tomorrow is a weekday.
2. Premise: People on this reality show are self-absorbed  
   Premise: Laura is not self-absorbed  
   Conclusion: Laura cannot be on this reality show  
   This argument is deductive. The conclusion is valid because Maria is outside of the set of self-absorbed people, so she must also be outside of this set of people on this reality show. Determining if this conclusion is sound is more difficult because determining if someone is self-absorbed is subjective.

*U*

Self-Absorbed  
People  
 Maria

People on this reality show

1. The first few terms of the sequence are 1, 3, 5, 7, 9 therefore the next term will be 11.

This is a strong inductive argument because we are given specific numbers in which we can find a pattern. Then based on that pattern we can determine that the next term of the sequence would be 11.

1. Premise: No apples are pears.  
   Premise:  A Pink Lady is an apple.  
   Conclusion: Therefore, a Pink Lady is not a pear.  
     
     
   The conclusion is valid and it is sound.

*U*

Apples  
  
  
X

Pears

*U*

Young

?

Children  
?

The conclusion is not valid and it is not sound.



*U*

Things   
that  
Faint ?  
  
?

Goats

The conclusion is not valid and it is not sound.

*U*

Failing

?

Miss 25% of class

?

This conclusion is not valid and because it is not valid it is also not sound. Claudia could have missed 25% of the classes causing her to fail. She could instead be failing because of low test scores.

1. This conclusion is valid and it is sound. Because Ethan is in the set of folks who missed 25% of the classes he also falls into the set of failing.

*U*

Apple Eaters

?

Dogs

?

*U*

Failing

Miss 25% of class

X

1. This conclusion is not valid and because it is not valid it is also not sound. Mary could   
   be a dog Mary could also be a worm, horse or human.
2. This conclusion is not valid and is not sound. We cannot determine if Juan took the test.

*U*

Entering   
Freshman. ?  
  
?

Test Taker

1. This conclusion is not valid. Because it is not valid it is also not sound. We cannot determine if Bob is a cat or not.

*U*

Peanut Butter liking  
  
 ?

Cats  
  
?